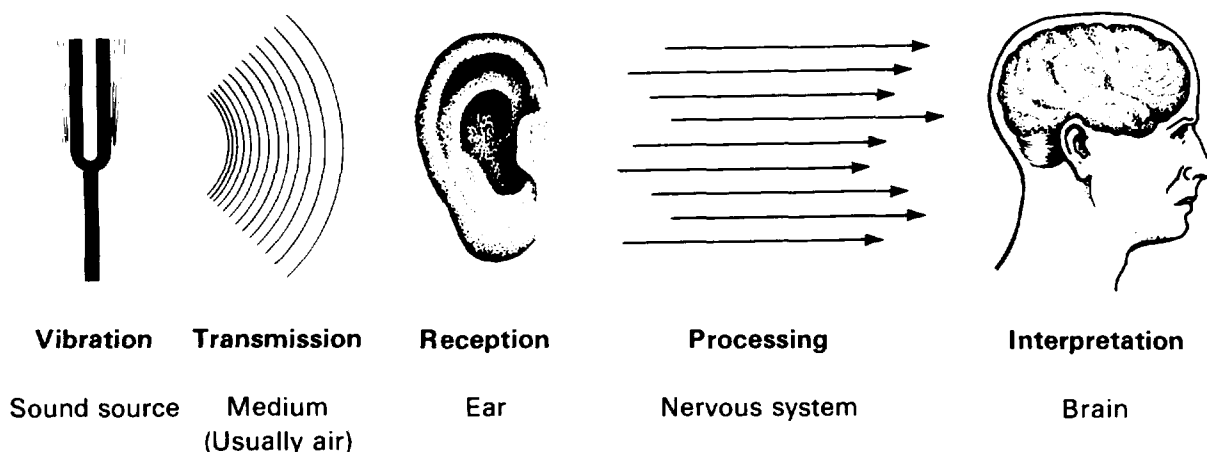


# CHAPTER 1

## NATURE OF SOUND

Sound is produced by vibration; there is no sound without a sound source in the physical state of vibration. The vibrating sound source transfers vibrational energy to the medium of transmission (gas, liquid, or solid) forcing it to vibrate. The medium, in turn, transfers vibrational energy to the ear, forcing the ear drum to vibrate. The human body's nervous system processes the vibration from the ear to the brain where the vibration is interpreted as sound.



*Figure 1.1: Nature of Sound.*

### CHARACTERISTICS OF A MUSICAL SOUND

#### *Pitch*

The number of sound waves per second produced by a sounding body is called *frequency*. Frequency is often expressed as the number of cycles per second (CPS) referred to as hertz (Hz). High frequencies are expressed in kilocycles or kilohertz (1 kHz = 1000 Hz).

When frequency of vibration is regular, it is called *pitch*. The pitch is higher when frequency is greater. When frequency of vibration is irregular, it is a sound source but is not pitched.

A regular vibration at 440 Hz (440 CPS) produces the pitch A.

Doubling the frequency (880 Hz) produces A an octave higher.

Halving the frequency (220 Hz) produces A an octave lower.

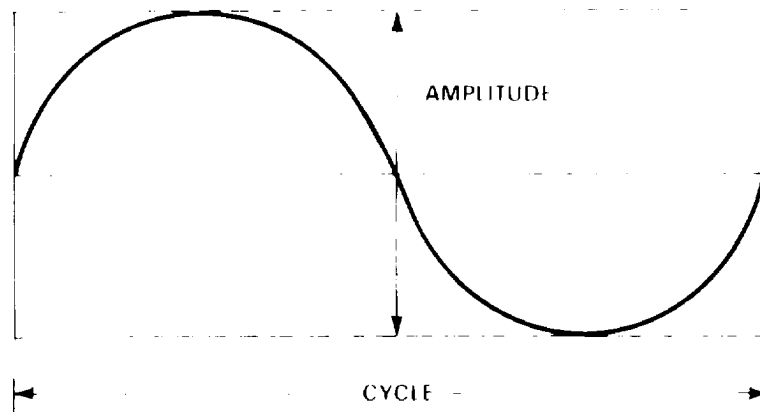


The approximate range of human hearing capacity is from 20 Hz to 16 kHz.

### *Intensity*

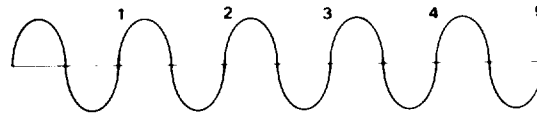
The magnitude of force or energy of regular or irregular vibration is known as *intensity*. Intensity, musically referred to as volume, is determined by the amplitude of the vibration of the sound source. The sound is louder when amplitude is greater.

Frequency and amplitude (pitch and volume) may be graphically represented by a simple wave form.

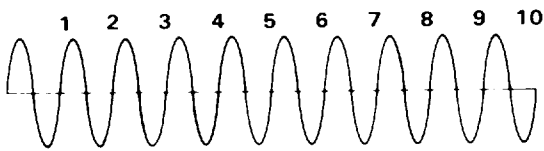


*Figure 1.2: Single Cycle Wave Form.*

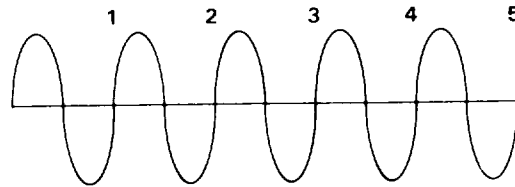
Frequency, the number of complete cycles within a given period of time, is represented horizontally. Amplitude is the displacement from center of the wave form and is represented vertically. Greater frequency indicates higher pitch; greater amplitude indicates greater volume.



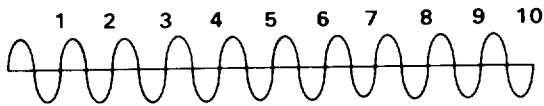
**Basic Wave Form**



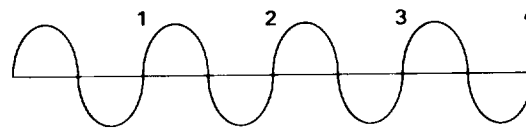
**Greater Frequency**  
(higher pitch)  
**Same Amplitude**  
(same volume)



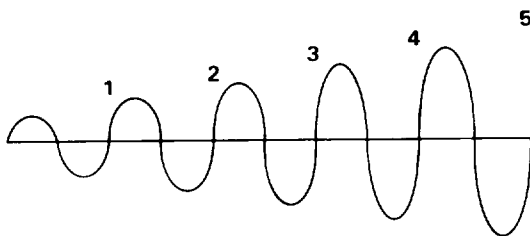
**Same Frequency**  
(same pitch)  
**Greater Amplitude**  
(greater volume)



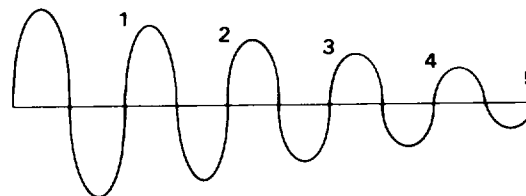
**Greater Frequency**  
(higher pitch)  
**Lesser Amplitude**  
(less volume)



**Lesser Frequency**  
(lower pitch)  
**Same Amplitude**  
(same volume)



**Same Frequency**  
(same pitch)  
**Increasing Amplitude**  
(crescendo)



**Same Frequency**  
(same pitch)  
**Decreasing Amplitude**  
(decrescendo)

*Figure 1.3: Wave Form Representation of Frequency and Amplitude.*

### ***Duration***

The length of time of vibration is called *duration*. Duration is the length of sound.

### ***Timbre*** (<sup>1</sup>tam-bər or <sup>1</sup>tim-bər)

The distinctive tone or quality of a singing voice or a musical instrument is known as *timbre*. Sounds identical in pitch, intensity, and duration produced by different types of instruments are dissimilar and reveal a difference in timbre or tone quality.

Timbre is affected by:

method of sound production (bowed, blown, plucked, or struck)

physical nature of instrument (relative strength of overtones)

condition of instrument

individual performance characteristics

### **SUMMARY**

***Pitch*** \_\_\_\_\_ highness or lowness of the sound.

***Intensity*** \_\_\_\_\_ volume of the sound.

***Duration*** \_\_\_\_\_ length of the sound.

***Timbre*** \_\_\_\_\_ quality of the sound.